

# Chapter 3

## Theoretical framework: Importance of training for the generation and appropriation of the culture of Research Ethics, Bioethics and Scientific Integrity Basic and Environmental Sciences

Nancy Esperanza Flechas Chaparro<sup>9</sup>  
María Consuelo Bernal Lizarazu<sup>10</sup>

### Abstract

Ethics applied to research is important to achieve valid scientific knowledge that is based on values and developed with a social approach. This chapter presents a theoretical framework on the importance of training from the approach of virtues for the actors that carry out the processes of CTel; it addresses the cognitive biases and their implications in the attitudes and behaviors related to the EIBIC, and establishes aspects associated with the training for the appropriation and generation of a culture in Research Ethics, Bioethics and Scientific Integrity in Basic and Environmental Sciences, thus contributing to the implementation of the Policy on Research Ethics, Bioethics and Scientific Integrity.

**Keywords:** ethics, bioethics, cognition, scientific knowledge, science, educational process.

<sup>9</sup> Psychologist, Specialist in Family Health, Mg Bioethics. Psychology, Emotional Development and Education Research Group. Latin American Network of study and intervention in happiness and well-being. Teacher. School of Social Sciences, Arts and Humanities. National Open and Distance University. UNAD. Email: nancy.flechas@unad.edu.co.  
ORCID: <https://orcid.org/0000-0002-5624-3971>

<sup>10</sup> Physician, Bacteriologist, MSc Microbiology, Mg Public health and social development. BIOINNOVA research group. Associate Professor. School of Health Sciences. Universidad Nacional Abierta y a Distancia-UNAD. E-mail: maria.bernal@unad.edu.co.  
ORCID: <https://orcid.org/0000-0002-9049-1629>

## Resumen

La ética aplicada a la investigación es importante para alcanzar un conocimiento científico válido, que se fundamente en valores y se desarrolle con un enfoque social. Este capítulo presenta un marco teórico sobre la importancia de la formación desde el enfoque de las virtudes para los actores que realizan procesos de CTel; se abordan los sesgos cognitivos y sus implicaciones en las actitudes y comportamientos relacionados con la EIBIC, y se establecen aspectos asociados con la formación para la apropiación y generación de una cultura en Ética de la Investigación, Bioética e Integridad Científica en Ciencias Básicas y Ambientales, con lo que se contribuye a la implementación de la Política de Ética de la Investigación, Bioética e Integridad Científica.

**Palabras clave:** ética, bioética, cognición, conocimiento científico, ciencia, proceso formativo.

## Resumo

A ética aplicada à investigação é importante para alcançar um conhecimento científico válido, baseado em valores e desenvolvido com uma abordagem social. Este capítulo apresenta um quadro teórico sobre a importância da formação a partir da abordagem das Virtudes, para os actores que realizam processos de CTI, aborda os preconceitos cognitivos e as suas implicações na geração do conhecimento, e estabelece aspectos relacionados com a formação para a apropriação de uma cultura de ética da investigação, bioética e integridade científica nas ciências básicas e ambientais, contribuindo para a implementação da Política de Ética da Investigação, Bioética e Integridade Científica.

**Palavras-chaves:** Ética, Bioética, Conhecimento, Conhecimento científico, Ciência, Processo de formação.

## 3.1 Introduction

The evolution of science and technology have allowed the continuous development of peoples for their well-being; however, it is important to consider the difference between development and economic growth: the latter is the one associated with *developmentalism* and overexploitation of non-renewable resources, and with the increase of the market with irreversible impacts on the environment (Serrano et al., 2015). It is proposed that development should value logic and science, as well as cultural traditions, the community, the environment, and that it should recognize different value systems (Rojas, 2001; cited by Guzmán Díaz, 2013). In this context and from the ethical perspective, development will manage to have a more humanistic approach, considering

that we cannot continue to generate changes that negatively influence living beings and their environment directly or indirectly.

This chapter is developed in three stages:

1. The theoretical framework on the importance of training for the generation and appropriation of a culture of Research Ethics, Bioethics and Scientific Integrity (EIBIC) in basic and environmental sciences is presented,
2. cognitive biases related to elements in EIBIC of basic and environmental sciences are described,
3. finally, and based on the above, we propose aspects for training in EIBIC and the modification of cognitive biases in the basic and environmental sciences, thus contributing to the implementation of the Research Ethics, Bioethics and Scientific Integrity Policy.

## **3.2 Importance of training for a culture of Research Ethics, Bioethics and Scientific Integrity**

When considering ethics in relation to research, it is emphasized that it is a part of philosophy that deals with good and bad; it develops with moral action, making it possible to modulate our moral orientations (Marcos, 2001). In practice, ethics orients the discussion before good or evil, or before good or bad actions. Morality, as stated by Cortina (2000), cited by Ojeda de López et al. (2007), is that “set of principles, norms and values that each generation transmits, in the confidence [that] it is a good legacy of guidelines on how to act in order to lead a just life” (p. 349). Although ethics is strictly theoretical, it is supported by other sciences or disciplines, which gives it a practical character: this is the case of ethics applied to scientific research, which should be aimed at working on scientific knowledge and, in an ethical way, to work in teaching and research to promote the training of interdisciplinary teams that allow scientific production to solve problems (Ojeda de López et al., 2007).

According to Siqueiros-Beltrones and Jaime (2015), “Science is a social invention and constitutes a collective phenomenon; the same property must be attributed to the scientific method, so its application is not necessarily at the individual level, but of the scientific community” (p. 32). Likewise, they highlight that “ethics is practical philosophy

and is essential in scientific training; its observation guarantees a search for adherence to the scientific method and the purposes of science (Siqueiros-Beltrones and Jaime, 2015, p. 48).

The reliability of the results and knowledge generated in research processes through the scientific method is fundamental. According to Michalek et al. (2010), mistakes in ethics in scientific research generate difficulties in the advancement of science. However, this is not its only effect, since it implies, among other things, a distrust in the products generated and the economic impact. These aspects are also related to problems in the generation of products with validity and representativeness of the research process and include methodological approaches, structure and adequate management of theoretical foundations that provide knowledge for research. In addition, the handling of data and statistics, as well as the choice of lines of research, can sometimes be fueled by non-scientific causes, such as economic interests. Some examples of ethical misconduct related to scientific research that have an impact on the advancement of science include fabrication or falsification of results, manipulation of data, graphs or images, plagiarism, and conflicts of interest (Marcovitch, 2007).

For Siqueiros-Beltrones,

the understanding of the concept of paradigm and the management of theory, as well as the methodology and the exercise of ethics as components of the scientific method and its philosophy, stand out as the modulators of the scientific personality, and contribute to the use of the individual virtues of the scientist. (2002, p. 194)

The preparation of the scientist implies considering the value of education and training in his or her training, including research ethics. As established by Siqueiros-Beltrones and Jaime,

The well-trained scientist obtains qualification through the integration of the three basic components (education, training, qualification). The latter implies a compenetration in specific theoretical and methodological knowledge, which he applies based on the ethical rules governing scientific activity. (2015, p. 76)

In relation to environmental ethics, its emergence is associated with the need to extend ethics for coexistence with nature (Legorreta, 2010). It has been proposed as environmental ethics that which is related to the use of the environment for the benefit of human beings, while ecological ethics conceives the human being integrated in an environment, where humans share their life with other species, which makes life possible (Costa, 2009). Traditionally, Western philosophy has denied the moral relationship between human beings and nature; nowadays, a responsibility towards nature is being recognized.

Concerning the shortcomings in the ethics of research related to the Sustainable Development Goals, on what was expressed by the former Secretary General of the United Nations,

Our globalized world is characterized by extraordinary progress alongside unacceptable and unsustainable levels of poverty, fear, discrimination, exploitation and injustice, and environmentally irresponsible behavior at all levels. However, we also know that these problems are not accidents of nature, nor are they products of phenomena beyond our control. They are the consequence of people's actions and omissions. (Ki-moon, 2014; cited by Ramos Serpa and López Falcón, 2019, p. 186)

A relevant aspect to consider is that “the use of biotechnology for human evolution is not disqualified, it will depend on the use given to wisdom” (Casquier and Ortiz, 2012, p. 282). Hence the importance of the responsibility and ethics of the researcher, who finds himself in a scientific and research system that “requires him to constantly compete for recognition and credit, which ultimately translates into resources and professional position of researchers, propitiating [sic] in some cases the emergence of ethical misconduct and fraud” (Camí, 2008; cited by Opazo Carvajal, 2011, p. 62).

Although it is often not recognized in scientific environments, ethics in research is indispensable. As established by Siqueiros-Beltrones and Jaime,

Scientific research is based on ethical values and principles, such as trust, honesty, responsibility, and respect. The progress of scientific research depends both on compliance with these ethical principles and on the veracity of the results and conclusions of the experimental work. (2015, p. 91)

These authors also consider education as one of the mechanisms for preventing the deviation of ethical principles. For Cuadros-Contreras, it is relevant to promote the ethical training of researchers; but it is not possible “without the production of a common, affective and valuative sense that accompanies, from the first moments at an early age, until the greatest milestones of our academic career, the effort to know” (Cuadros-Contreras, 2019, p. 235); in this same line, referring to training in bioethics, Abellán and Maluf (2014) mention that, in addition to develop at the university level, it should be implemented in secondary education, when the adolescent and young person are defined and reaffirmed in their personal ethical criteria. These positions, according to Rangel, are in accordance with “the basic moral character of any individual that is formed from early childhood” (2019).

Thus, training in EIBIC is a gradual process, without forgetting that, in addition to research activities, the scientist participates in processes that involve establishing ethical considerations. For Siqueiros-Beltrones and Jaime,

participation as scientists, researchers, or experts, leading to decision-making on bioethical topics requires an ethical recognition of our own capacities and competencies, as well as self-criticism, both individually and at the level of the scientific community... It is not convenient to improvise ethical principles; one is not born knowing ethics; even when ethics is based on honesty and moral education, it requires special attention. (Siqueiros-Beltrones and Jaime, 2015, p. 89)

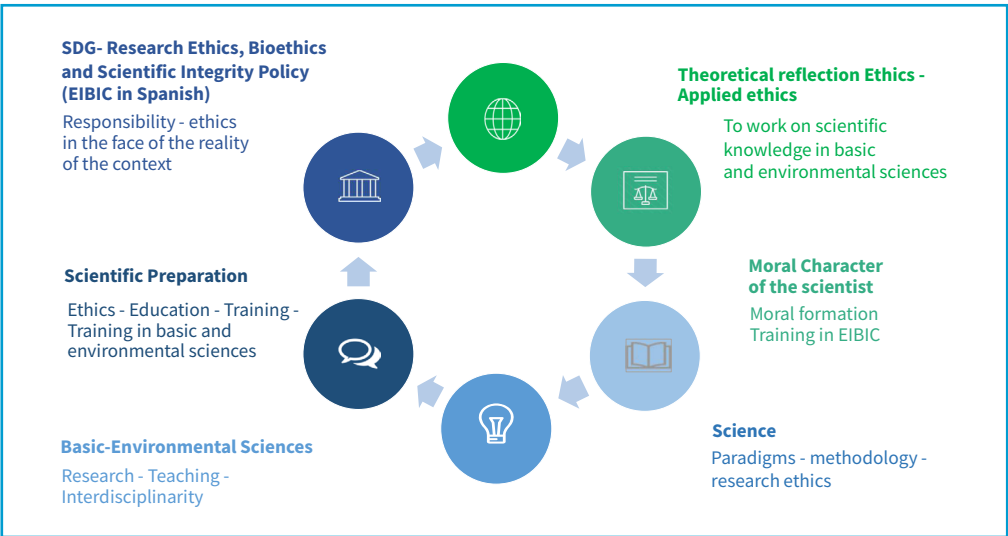
Similarly, Bunge (1978) emphasizes the importance for the scientist to consider as a manifestation of his professional and scientific honesty to be trained throughout his active life, considering that, however prepared they are considered, they will always be half-finished products. Today, researchers in training are facing ethical, epistemological, and methodological debates, which will have repercussions in the scientific, technological, social, cultural, economic and institutional spheres due to the consequences of their decisions.

Abellán and Maluf (2014) consider “three components in Bioethics training: the sociocultural context, conceptual and methodological frameworks”. Furthermore, as mentioned by Rangel (2019), training is a “process that can be reflected in the change of attitudes and behaviors that lead to the formation of a professional with human and social sensitivity, critical of his training and his participation in the construction of a society with well-being and better quality of life...”. (p. 88).



**Today, researchers in training are facing ethical, epistemological, and methodological debates, which will have repercussions in the scientific, technological, social, cultural, economic and institutional spheres...**

**Figure 7.** Importance of training in Research Ethics, Bioethics and Scientific Integrity in basic and environmental sciences.



**Source:** Author's preparation

### 3.3 Cognitive biases, attitudes and behavior in science, technology, and innovation

Cognitive biases are systematic errors resulting from the evolutionary need to generate judgments quickly (Rodríguez, 2012). According to Villaruel-fuentes, “it is understood as a mechanism by which a resolution is reached quickly, even if this implies a certain degree of superficiality” (2019). For Rodríguez (2012), it implies a subjective and selective filtering of information, which leads to wrong decisions and conduct in certain contexts, on many occasions, of an ethical nature. They affect especially critical capacities in the scientific world, such as making objective value judgments, attributing causal relationships, or establishing hypotheses (Redondo, 2020). For Romero-Fernández, “science as such, and not only its products, has ethical implications” (Romero-Fernández, 2016, p. 5), and the neutrality of science is questionable, considering “the research process, its policies and economic determinants, biases in the transmission of information, etc.” (Romero-Fernández, 2016, p. 4).

### 3.3.1 Cognitive biases and basic sciences

One of the common aspects in a scientist is the decision making about the data obtained from experiments, the experiments themselves and their conclusions, among others, which can be disturbed by the presence of cognitive biases that interfere in the achievement of results, validity, and reproducibility. Redondo (2020) reports recognized cases of scientific activities in which the presence of biases has negatively influenced the results; this is the case of the use of the pesticide aldrin, used between 1950 and 1970, when the United States Department of Agriculture banned its use, since the measurement of its risk was not adequately performed because it did not take into account all the variables.

The existence of these biases can lead scientists to adopt attitudes related to rejecting ideas that do not coincide with their way of thinking, or the opposite, accepting ideas, even if they are not sufficiently proven, among others, which would damage the ethical nature of the research.

**Egocentric biases:** As the lack of knowledge related to epistemology. In this sense, it is important to consider that ethics is the discipline of philosophy that studies the principles that regulate the moral action of human beings and epistemology; it studies scientific research, scientific knowledge, and is a discipline of philosophy (Bunge, 2006). Ethics in research is associated with the interaction that these two have, and the consideration of epistemological trends allow the achievement of valid products obtained with scientific rigor (Romero Fernández, 2016). According to Siqueiros-Beltrones and Jaime (2015), many researchers relegate the philosophy of science from their discussions, and, by following methods, work on a problem, while the scientist understands and manages the philosophy of science, and thus confers the status of scientific to the research.

**Methodological concepts:** The researcher must take into consideration a fundamental objective of the research activity: to obtain valid knowledge. According to Siqueiros-Beltrones (2002), they may be influenced by methodologies, their structure, management of theoretical foundations, as well as data and statistics management. In their training, the scientist must acquire conceptual clarity of what is the methodology for the development of productive research in all its context. In this regard, Redondo (2020) includes information on the work developed by NASA on the evolution of the ozone hole, for which studies had been conducted, but were not published until 1985 due to inadequate data management -a cognitive bias-. Finally, it was established that there was ozone depletion and a hole in the South Pole.

**Lack of knowledge to work with the community:** It can lead to the persistence of inappropriate behaviors; it is essential to know the processes, guidelines and documents that strengthen the intervention processes to promote “the well-being of each individual,



family, group or community and of the human species as a whole” (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2005, p. 6).

The Diagnosis of training needs in EIBIC reports that researchers in the basic sciences lack experience and knowledge, and that they have difficulties in “developing projects with communities, where the context and the socioeconomic situation that influences the problems are not recognized” (Useda et al., 2021, p. 149); it also highlights the need for researchers to be aware of the reality in a non-fragmented way and to consider and reflect on the effects of the projects on the social dimension (Useda et al., 2021).

**Lack of knowledge of research guidelines in protocols, principles and processes:** Not only the methodological, but also the ethical aspects must be considered, taking into account its background and maintaining a self-critical stance, since, as Villarruel-Fuentes (2019, p. 66) mentions, “when it comes to research, it is convenient to change questions, so as to change answers” and not to follow the trend of approaching different phenomena in the same way.

**Data processing:** One of the aspects that can generate systematic errors and false results in research reports are errors in the recording and handling of data. As stated by Redondo,

many important decisions about which experiments are conducted (and which are not), as well as which results are published (or kept in a drawer), do not really respond to an objective method, but to various forces, such as interaction with our peers or confidence in our intuitions and interpretations. (Redondo, 2020, p. 18)

Statistical analysis is fundamental in scientific activity and its application depends on the researcher. It is necessary for the researcher to deepen the knowledge for the collection and analysis of research results and to maintain a critical view of its scope and limitations. In addition, adherence to certain statistical procedures can facilitate their use, even on occasions when they are not the best. According to Villaruel,

the human brain likes to apply known solutions, since trying new things, through trial and error, implies a new investment in time and effort: the brain, if it already knows a solution, becomes “blind” to other possible solutions. (Villarruel-Fuentes, 2019, p. 40)

**Availability bias:** It includes the lack of knowledge of ethical aspects in researchers, which they have manifested in the area of basic sciences, according to the work done by Minciencias on training needs in EIBIC: they referred not only to the lack of training in

the subject, but considered as justification that their research does not influence human beings (Useda et al., 2021). The traditional vision of science based fundamentally on positivism tends to be raised far from the values and ethical dimension of the human being; however, as Salazar (2018) manifests, subjectivity, ethics, and axiology have been retaking in scientific activity to understand the relationship between society, culture and the construction of knowledge. Additionally, new advances establish the need for ethics in scientific action, such as in artificial intelligence (AI), for which the office of the Presidency of the Republic of Colombia published the Ethical Framework for AI (Presidency of the Republic, 2021).

**Loss of researcher's goals:** According to Siqueiros-Beltrones and Jaime (2015), it implies establishing the importance of demanding high standards of professional behavior from researchers, given their social commitment and responsibility, in order to develop scientific research that solves the needs of the population, in coherence with political and economic components of the environment.

**Preconceived ideas about the importance of ethics and bioethics:** We can identify its existence by considering the intuition biases evidenced in the study conducted by Minciencias (2021). According to this, for the area of Basic Sciences, it was found a lack of knowledge about ethics in research, concepts such as bioethics, and additionally, the conception that it is not related to the area of knowledge (Useda et al., 2021). This implies not recognizing that science has ethical implications, and that scientific activity is not independent of the possibility of lack of neutrality due to methodological, political, economic or transmission factors of scientific information (Romero Fernández, 2016).

**Lack of knowledge of research projects as part of lines of research:** At the end of the 20th century, epistemological positions appeared to elucidate how scientific knowledge grows, starting from the notion established by Imre Lakatos of research programs, which establish scientific research as a programmatic and transindividual process; although a research can be analyzed individually, it acquires meaning when its value is considered among a sequence of research processes, supporting the concept of lines of research and its importance (Padrón, 2007). Additionally, the selection and work in lines of research established by non-scientific, but rather economic interests, has a negative impact (Siqueiros-Beltrones, 2002).

**Anthropocentric approach:** It is important to note that “the moral ethical framework of the West has considered man as a superior creature and divine predilection to dominate over other species, which, in any case, have been considered inferior and instrumentally used for exclusively human interests” (Cardozo and de Osorio, 2008, p. 48), which contributes to their deterioration and destruction. It is important to bear in mind that the acts performed by man are in themselves moral acts.

**Regarding research with animals:** The debate generated by the abolitionist position establishes that they should not be used to manipulate workers' decisions. Their use has not been replaced in its entirety, so other positions have been put forward, such as the dilemmatic position, which considers the justification of their use when there is a lack of alternatives, while the unrestricted position justifies the use of animals in research if they generate a benefit for human beings (Vega Ángeles and Ortiz Millán, 2021). The researcher should be clear about the ethical conditions for the development of animal research, considering established guidelines such as the recognition of the 3 Rs (Barrios et al., 2011).

**Omission of interdisciplinary research:** Interdisciplinarity “states that several scientific disciplines can collaborate mutually to produce scientific development and thus the construction of knowledge” (López, 2012, p. 370), and avoid their fragmentation. This movement developed in the last two decades as a need for the participation of various disciplines in the development of research, so that a look from various perspectives was reached. On the other hand, in the group of so-called applied ethics, among which are bioethics, ecoethics, information ethics, among others, there has been a need for interdisciplinary dialogue (García, 2011).

### 3.3.2 Cognitive Biases and Environmental Science

**Egocentric biases** in which the lack of training in values is identified. The World Declaration on Higher Education recognizes that society is experiencing a crisis of values:

This would be one of the crises of ethos and probably the one that has the strongest impact on social-political structures, which is not a “crisis of values” as it is often called, but a loss of the legitimacy of acting in accordance with values, in fact putting the very meaning of validity in crisis, in a world that lies under the reign of strategic rationality. (De Zan, 1993; cited by UNESCO, 2012, p. 19)

This leads us to reconsider values and human action under common and shared ontological, epistemological, and conceptual premises in relation to natural entities and the possible ethical, environmental and social consequences. Undoubtedly, “we live in a plural, secular and free world, and in it we accept to coexist with others who have different values” (UNESCO, 2012, p. 20). In the face of the crisis, different positions are evident in the light of the realities of the world. Therefore, researchers face the challenge of having a critical, initiative-taking and coherent position in terms of ethics and scientific integrity.

**Lack of training in Research Ethics, Bioethics and Scientific Integrity:** According to the reality of the territories, the State, the society, the academy, and the contents with their own characteristics, it is a challenge for higher education institutions. In this regard, Guerrero and Gómez (2013; cited by Briones and Lara, 2016, p. 100) “confirmed this absence of ethical and moral education of the person in the Ibero-American region”, highlighting its impact on the development of the members of society.

**Lack of interdisciplinarity in training and research:** Gonzalez-Escobar considers, for the approach to the environment,

Both the context of nature and the sociocultural relations, in which human subjects inhabit in a conditioned way; but, at the same time, conditioners of the system. This systemic characteristic allows us to understand that environmental problems are assumed interdisciplinary to understand their complexity, their constitution as an organized totality in which any change in one of its parts affects the others. (González-Escobar, 2017, p. 6)

In training, in addition to disciplinary, technical and methodological competence, the researcher must be able to move through the different areas of knowledge in order to consider the different aspects of environmental sciences. According to Faralli, “bioethics is really configured as an ideal field to realize a relationship of interface [*sic*] between natural sciences and human sciences...” (2014, p. 18).

Culture and traditional knowledge are not considered: Some research ignores cosmologies, knowledge, community needs and community resource management. According to UNESCO (2021),

knowledge and uses related to nature and the universe encompass a series of knowledge, techniques, skills, practices and representations that communities have created in their interaction with the natural environment. These ways of thinking about the universe, which are expressed in language, oral tradition, sense of attachment to a place, memory, spirituality and worldview, have a significant influence on values and beliefs and form the basis for many social practices and cultural traditions.

**Ethical and bioethical dilemmas in environmental issues:** For Sarukhán (2019) there are three issues that must be understood in an integral way. The first is responsibility towards nature, the second is responsibility towards present and future human beings, and the third refers to the context of our behavior towards nature for the benefit of our species.

**Availability bias.** They include the anthropocentric approach of researchers. According to Vallejo, “when scholars argue that humans are the only beings worthy of moral

considerability, their ethical position can undoubtedly be categorized within the realm of anthropocentrism” (2019, p. 15); moral considerability is a challenge for ethics relevant to training processes in EIBIC.

According to Márquez-Vargas, “the environmental dimension of bioethics was structured from the founding ideas of Jahr, Leopold and Potter, which mark a conceptual line that establishes an abandonment of anthropocentric ethics, to move towards an ecocentric model” (2020, p. 1).

Regarding research funding, Leopold wrote in the essay *The Land Ethic*, that “a system of conservation based solely on economic interest is hopelessly unbalanced” (1949, p. 251 cited by Kwiatkowska, p. 52); on many occasions decisions guided by monetary values do not foresee the environmental effects and risks that in some cases are irreversible, “it was Leopold who defined the environmental crisis as a failure rooted in economic activity, with an ethical basis” (Sarmiento, 2000, p. 33 cited by Márquez-Vargas, 2020, p. 9).

**The ontological approach in which the researcher is formed:** For Levinas, the ontology of egoism privileges possession, and is the “form par excellence through which the other becomes the self by becoming mine” and displacing the other (Levinas, 1977, p. 70; cited by Montero, 2010, p. 92). The fact that the researcher assumes this type of position leads to a practice of power, domination, exclusion, denial of the rights of the other, which diminishes the possibilities of communities, groups and society.

Montero considers “knowledge as praxis; knowledge as dialogue; the inseparability of the Self and the Other; the relationship as the true locus of being; the ethical imperatives of overcoming exclusion and transforming the living conditions that produce it” (Montero, 2010, p. 84), and proposes a dialogic, horizontal relationship between the different actors of the research system in which one can accept another with different ways of knowing each other. The training does not have methodologies or pedagogical strategies, active or practical in situated contexts, which leads to the need to recognize the meaning of educating, with “the contribution from higher educational instances to the training of professionals with strong ethical convictions” (Briones and Lara, 2016, p. 100). In this regard, Pasmanik and Winkler (2009; cited by Briones and Lara, 2016, p. 100) “argue that this trend is due to the ethical training during the university years, characterized by being scarce, theoretical and decontextualized, neglecting in turn the reflection and discussion”. Research training has challenges in the implementation of innovative pedagogical strategies.

**Intuition biases:** These include a lack of critical thinking. According to UNESCO, “reality calls for a reflective and critical attitude towards the environmental situation and climate change” (2012, p. 11) in our continent. “The subject of action was never free, nor was everyone granted the opportunity to build a critical reason, because freedom

and criticality are only achieved through a comprehensive education” (Rusconi and Cubillos, n. d., p. 2), so ‘it is essential that higher education, in addition to focusing on professional preparation, considers the development of personal skills such as critical reasoning’ (Rusconi and Cubillos, n. d., p. 2). (Nussbaum, 2005; cited by Briones y Lara, 2016, p. 100).

**Lack of clear guidelines for environmental damage prevention:** It is necessary to have a well-founded debate on the production and application of scientific knowledge, based on the proposal of Potter (1988), who states that this state of affairs:

leads world leaders and decision-makers in local or regional public administrations to understand the urgency of environmental bioethics in the face of events that lead to the destruction of the natural environment, on which, of course, the life of all beings depends. (cited by Márquez-Vargas, 2020, p. 14)

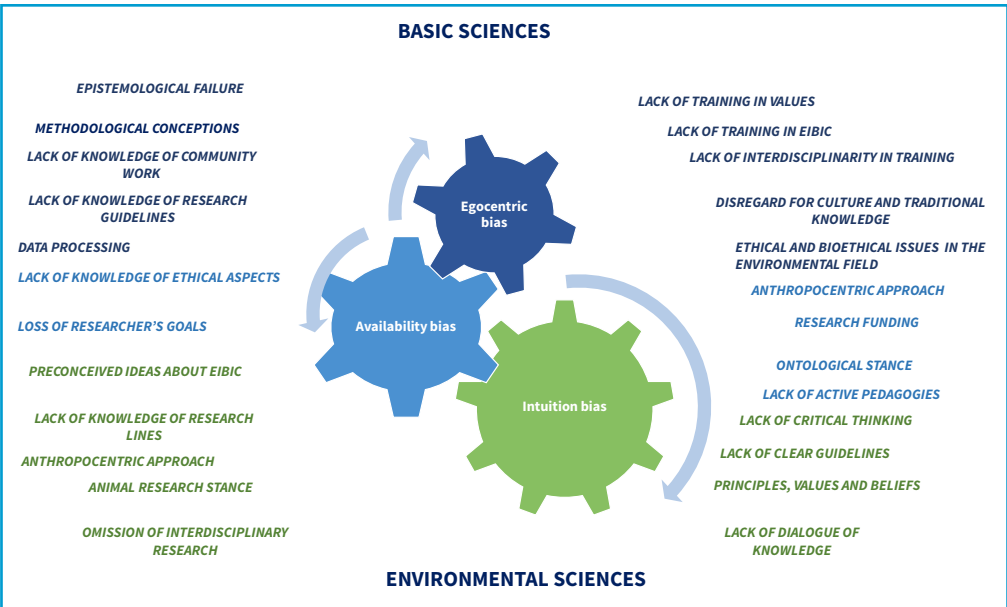
Principles, values and beliefs González-Escobar, (2017)

the ethical discussion is centered on values, it is necessary to discuss more than an environmental ethics, but rather to move towards an ethics of development, under the influence of a new relevant discourse based on integrative values, which define systemic thinking and the complexities of the interactions between the ecosystem and the cultural and social systems. (p. 12)

In the ethical field, by proposing that nature is subject to intrinsic value, we are not accepting an exchange value; we are referring to its ecosubstantiality as a living system, from which we derive a vital importance for the ecosystem. We coexist with new situations generated by the cultural and the scientific, which influence our worldview on environmental problems, as a result of human decisions in research practices, and in turn influenced by techno-scientific, political, economic and aesthetic aspects (Márquez-Vargas, 2020).

**Lack of dialogue of knowledge:** Cuadros-Contreras (2019) quotes Habermas (2000), who states that “it is a matter of basing moral imperatives, no longer from an individual rationality assumed in all humanity and based on a priori concepts, but in the intersubjective exercise of dialogue”. Dialogue should, as Montero (Montero, 2010, p. 85) states, “recognize the Other as a social actor and respect his/her condition as a constructor of knowledge, as a producer of a history”. In this dialogue new forms of knowledge are built; “with the incorporation of an integrative and respectful ethical perspective of nature and its harmonious relationship of scientific bodies, leaders and other human subjects will be contributing to promote an inclusive social paradigm” (Gonzalez-Escobar, 2017, p. 15).

**Figure 8.** Cognitive Biases in Research Ethics, Bioethics and Scientific Integrity in basic and environmental sciences.



Source: Author's preparation (2023)

### 3.4 Training towards the appropriation of a culture in Research Ethics, Bioethics and Scientific Integrity

In relation to the traditions of ethical thought, it is worth mentioning *consequentialism* and *deontologism* as the strongest ones. The first considers that the moral fit of our actions depends on the consequences of them; it understands an action as morally correct if the things it produces are good. In the case of deontologism, this proposes that the morally correct action is that one that is done based on a moral norm; thus, the right takes precedence over the good (Cuadros-Contreras, 2019). It is relevant the categorical imperative of Kantian ethics that reads as follows: “act only according to such a maxim that you can at the same time will that it becomes universal law” (Kant, 1995, p. 39, cited by Malishev, 2014, p. 13), and also desirable, hence moral action is expressed in well-defined norms by a universal criterion.

Deontology and consequentialism defensively pose research ethics. It would be a reductionist conception, more so considering that ethics is not only a matter of codes and regulations, and should be much more open, more so when thinking about the relations between the search for knowledge and ethics (Cuadros-Contreras, 2019).

The tradition of virtues as a fundamental position for the ethical training of the researcher: according to Romero, “virtue ethics is the basis of the good, Aristotle pointed out that cultivating a good character implies developing certain virtues” (2016, p. 49). And it is a knowledge that serves as a guide to conduct life, a relevant position for the training of those who conduct research, as Cuadros-Contreras states:

The approach of virtues advocates an affirmative conception of ethics, it is not content with maintaining an attitude of responsibility or care, it is not satisfied with acting cautiously to reduce the risk of harm, it goes much further: it considers that what essentially defines ethics, and this is decisive for training researchers, is its effort to help the full realization of subjects and communities, in this lies all its commitment. Thus, it connects with politics, as it was originally thought of in antiquity. (2019, p. 240)

Although scientific technical development has generated advances and benefits, there have also appeared ways of aggression to the dignity of the human being, and ethics in research and bioethics propose a rethinking of the way of doing science responsibly, focused on the care of the human condition and dignity, nature and all the contexts involved with the development of science (Fuentes and Corral, 2018).

Currently, it is the responsibility of university entities to produce knowledge through research activities, the training of human talent; but also, to form opinions and trends, which establishes a social responsibility: these scientific advances and responsibilities establish new problems, including those related to ethics (Colina Vargas and Vargas De Carrasquero, 2018).

Mogollón (2007) states that professionals and researchers must have training in values that allow them to solve problems sustained by several components: academic, scientific, ethical, competencies and community. A research culture must be established that includes attitudes, values, objects, methods, techniques and organizations, and establishes the need to consider, among others, researching according to the standards of the scientific community; it must work with methodological rigor, systematically, use appropriate methods and assume an ethical attitude (Fuentes and Corral, 2018).

Ethics in research regulates the morality of the researcher, and epistemology studies scientific research and its product, i.e., scientific knowledge. Additionally, research



methodology is essential in the process of knowledge construction. Currently, other dimensions are considered, as established by Colinas and Vargas (2018):

Now, it is necessary to consider other dimensions besides the epistemological, gnoseological, methodological, but also the axiological dimension, which imprints a series of actions, including an act of decision and intellectual honesty around the scientific, humanistic, philosophical and educational value. (p. 18)

Additionally, the professor and researcher play an essential role as generators of knowledge in the technical-scientific training, as well as in ethics and values of the student, and their attitude, behavior and worldview play an essential role.

Scientific work is done for the development of knowledge and the search for truth, the scientist must consider the factors that may interfere with the achievement of his goals. In relation to the ethical problems present in the research process, Colina and Vargas (2017) approach them from four edges in a general way.

- Researcher's own aspects:
  - those related to their clarity about their responsibilities as researcher and trainer, including the incorporation of ethical and moral aspects in research,
  - those related to the research subject participant and the need to consider all aspects related to this interaction.
- Aspects of the research process:
  - related to planning, methods, results management, and their dissemination and impact on society,
  - related to other researchers or research groups.

As a factor that is inherent to the researcher, it should be considered that there are cognitive biases that, as Redondo mentions, “they affect especially critical capacities in the scientific world: the ability to decide correctly, to make fair estimates, to make objective value judgments, to attribute causal relationships or to establish hypotheses” (2020, p. 18). It is necessary then that the researcher, “no matter how much scientific attachment he shows, must pay attention to all these behavioral phenomena, which, although they are psychological in nature, are also, to a large extent, biological and social” (Villarruel-Fuentes, 2019, p. 65). Thus, the researcher must know and control the risk or presence of cognitive biases, considering that they are inherent to cognitive processes; highlight the importance of self-criticism in their work; encourage the use of work methods, and make decisions more rationally (Redondo, 2020). In addition,

the recognition of collaborative work and dialogue, as well as interdisciplinary work in scientific activity, allows broadening the vision and the development of a research activity with contributions from various perspectives that facilitate the reduction of biases and better knowledge of the subject.

The scientist is prepared by means of three basic components: education, training and qualification, which must include the ethical component that governs scientific activity. Although ethics is based on the researcher's honesty and education in values, no one is born knowing research ethics and bioethics, and this knowledge must be considered by the scientist and in the training of professionals in the field of science (Siqueiros-Beltrones and Jaime, 2015).

Regarding training in EIBIC, according to Casado (2011), it is important to distinguish between education-training and information:

Through information, data and knowledge are transferred, without evaluation or orientation. Education and training, on the other hand, go a step further and can be considered as similar, since they transmit values and teach how to prioritize and evaluate them. (p. 67)

The process of education in research ethics and bioethics should encourage critical and reflective thinking and the recognition that there are different moral models, as well as the coexistence of values and principles on which democratic society is based; it should be based on the plurality of values and principles, which require a multidisciplinary and pluralistic view for their analysis. Pulido et al. (2019) state that

ethical education and also bioethics in universities has been characterized by the transmission of philosophical trends, norms or codes, aimed at being a guide for action in the form of maxims that are to guide professional conduct and excellence. (p. 34)

Referring to education in basic and environmental sciences, it can be defined as “the interdisciplinary process to develop citizens who are aware and informed about nature as a whole... with the capacity to assume the commitment to participate in problem solving, make decisions and act to ensure environmental quality” (Rick Mrazek, 1996; cited by Flores, 2012, p. 1021).

Cognitive biases, the researcher's metacognitive skills and the processes of research in basic and environmental sciences have a close relationship that can be addressed through the didactics of research, in order to promote a comprehensive training, considering the training in research ethics and bioethics in the areas of basic and environmental sciences.

Based on the approach of the virtues of ethical thinking, Jofre's (2019) discussions on didactics become relevant when he quotes Camilloni (2007), who states that the differentiation of didactics depends on different parameters and serve the purposes of different teaching configurations. For example, specific didactics: according to the different levels of the educational system, depending on the ages of the students, according to the discipline, depending on the type of institution, according to the characteristics of the subjects (p. 34).

One of the aspects in EIBIC training is the alignment of didactics with the pedagogical component. The Universal Declaration on Bioethics and Human Rights (UDBHR) indicates that there must be

the interconnection between human beings and other forms of life, the importance of appropriate access to and use of biological and genetic resources, respect for traditional knowledge, and the role of human beings in the protection of the environment, the biosphere and biodiversity. (UNESCO, 2005; cited by Abellán Salort and Maluf, 2014, p. 57)

Hence, the subjects should combine inductive and deductive pedagogy, so that they are practical in all sessions, adapting to the level of knowledge and academic maturity of the group. The training for collaborating with communities should promote argumentative strategies:

Yepes, Rodríguez and Montoya (2006; cited by Briones and Lara, 2016, p. 101) state that this strategy is an event of thought in which the laws of reasoning are involved (logic); the rules to prove or refute (dialectics), and the use of verbal resources in order to persuade, alluding to affections, emotions and suggestions (rhetoric). These characteristics of argumentation are linked to the training in values.

For Sanches and De Siqueira (2017), contemporary education seeks to

- more democratic educational institutions committed to social and cultural contexts
- teachers open to dialogue and train in educational methodologies,
- autonomous teachers, committed to their own learning process, and equipped with social responsibility,
- more community participation in education.

Education is based on an open and clear dialogue between the student and the teacher, on the respect for the dignity of the human being, highlighting values.

Ethics education is a learning process and cannot be just a collection of knowledge:

Based on three reflective dimensions-phenomenal, hermeneutic and teleological, we develop the idea that education in scientific culture involves a

“learning to learn”; a proposal that concludes thus in the need to make an attitudinal change from the interest in transmitting only encyclopedic and instrumental knowledge to a meta-knowledge that interrogates ethical-cognitive skills in the new contexts generated by scientific and technological advances. (Lahitte and Sánchez Vázquez, 2014, p. 5)

According to Pulido *et al.* (2019),

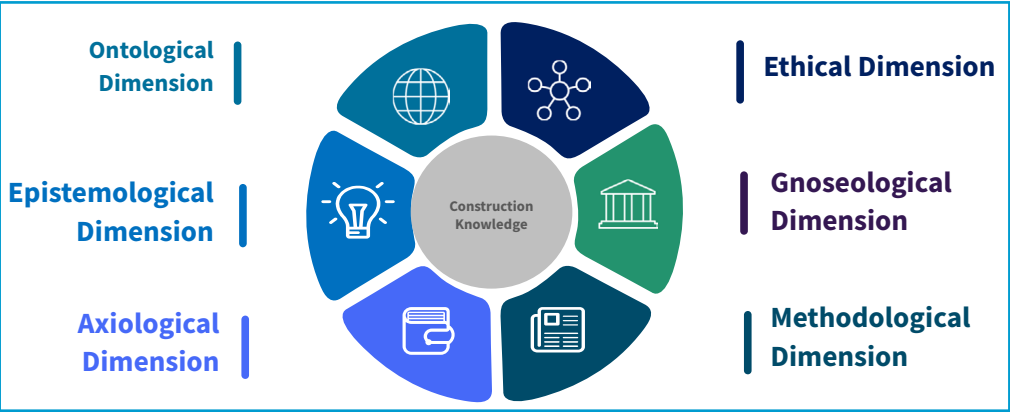
it has been demonstrated that didactic strategies in themselves, such as case studies, ethical matrices, critical incidents, video analysis, films, etc., can contribute, roughly speaking, to the promotion of competencies that allow for discussion around dilemmatic situations in academic and professional practice. (p. 36)

In this process it is also important to keep in mind that “the teaching of bioethics, as proposed by UNESCO, should introduce the student in three areas of cognitive domain, such as knowledge, skills and new attitudes” (Sanches and De Siqueira, 2017, p. 83), to generate an ethical conscience and with integrity on the application of scientific knowledge.

In ethical training at the higher education level, some authors have contributed research on ethical training focused on personal and professional values. This is the case of Briones and Lara’s (2016) proposal on “ethical training through the development of dialogic methodology, and the use of new communication technologies to allow contact between students from diverse cultures and degrees” (p. 100).

Another experience on the development of research training courses is the one cited by Opazo (2011), called sensemaking or construction of ethical sense, proposed by Mumford *et al.* (2008); this model presents characteristics that can be generalized and adapted to different fields of science, the investigation of ethical problems in situated contexts, to generate changes in the structure of the mental model of researchers in training.

**Figure 9.** Dimensions for the construction of scientific knowledge in basic and environmental sciences.



**Source:** Author's preparation (2023)

## Conclusions

As has been shown, in the field of higher education there are deficiencies or shortcomings in the ethical training and scientific integrity of the researcher, in the process of knowledge generation in the area of basic and environmental research. Therefore, today's realities demand integral training, especially in the ethical dimension and integrity of researchers, in order to face and solve the demands and challenges of today's world in a responsible and committed manner.

Considering resizing the production of scientific knowledge, including axiology and strengthening other aspects such as epistemology, methodology and ethics, will facilitate a research culture that generates reliable results with social impact. Additionally, for the training of the scientist it is important to consider the cognitive biases that may appear at any time during the course of the research; what is relevant is our attitude towards these biases, it is to know them in order to avoid them.

In general, experts in education in research ethics and scientific integrity propose an innovative training that goes beyond the teaching and learning of codes and norms of the profession, to generate critical thinking, ontological and epistemological positions of the relationship based on specific pedagogies and didactics. These training processes

require a great commitment on the part of all the agents involved in the CTel system, in order to overcome the two traditions of ethical thinking - consequentialism and deontologism -, to give priority to the tradition of virtues and to promote virtues for the training of the ethical character of the researcher and the transformation of his conscience in decision making. This will allow a more affirmative stance that not only establishes the prevention of risks, but also promotes the development of the researcher and society in the production of scientific knowledge in a reliable way in basic and environmental sciences.

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